

FINAL REPORT

Independent Peer Review of the California High-Speed Rail Ridership and Revenue Forecasting Process

Findings and Recommendations from the April 11-12, 2013 Peer Review
Panel Meeting and Associated Work April 1 through May 15, 2013

May 29, 2013

The Peer Review Panel held its ninth formal meeting on April 11-12, 2013 at the Parsons Brinckerhoff offices in San Francisco. The Panel also conducted discussions via electronic mail before and after this meeting. This report covers their activities and deliberations during the month of April. The panelists include:

- Frank S. Koppelman, PhD, Professor Emeritus of Civil Engineering, Northwestern University (chair)
- Kay W. Axhausen, Dr.Ing., Professor, Institute for Transport Planning and Systems, ETH Zurich (Swiss Federal Institute of Technology Zurich)
- Eric Miller, PhD, Professor, Department of Civil Engineering, University of Toronto
- David Ory, PhD, Principal Planner/Analyst, Metropolitan Transportation Commission
- Kenneth A. Small, PhD, Professor Emeritus, Department of Economics, University of California-Irvine

All panelists were present in person for the meeting with the exception of Professor Axhausen. Rick Donnelly, PhD, of Parsons Brinckerhoff (PB) served as facilitator and recorder for the Panel. In this capacity he serves at the convenience of the chair rather than as a representative of the project management team. The Panel invited several others to attend the first day of the meeting. They included Jeff Buxbaum, Rachel Copperman, David Kurth, Jason Lemp, and Kimon Proussaloglou from Cambridge Systematics (CS) and Thierry Prate from PB. Jeff Morales, executive director of the CHSRA, joined by teleconference late in the afternoon. The deliberations of the Panel on the second day were closed to non-members, with the exception of briefly providing feedback to the CS staff and Thierry Prate.

1 Review of CS Reports

The Panel reviewed materials presented by CS before and during the meeting.

1.1 Written material in advance of meeting

CS provided the panel with documents describing progress on:

- Access-egress mode choice models, including both a memorandum and a spreadsheet with currently estimated model coefficients
- Model version comparisons, with a table comparing features of model versions 1.0, 1.5, and 2.0
- A detailed time schedule for work on steps leading to production runs using Model 1.5, including presentation at a tentatively planned review panel meeting in June 2013.

The panel reviewed these documents in advance of the meeting.

1.2 Pre-recorded presentations

CS made four presentations on April 5, in advance of the meeting, which were recorded and distributed to the panelists for those who did not participate in the live videoconference presentations. The topics of and names of the respective presenters were:

- Model version comparisons (David Kurth): elaboration of the comparisons in the second of the documents described in Section 1.

- Calibration of Intra-regional model for SCAG region (Rachel Copperman)
- Development and calibration of intra-regional model for the MTC region (Monique Urban)
- Analysis of California Household Travel Survey Data (Eric Bearse)

2 Topics discussed with CS staff

During the meeting the panel heard additional presentations by CS staff and discussed specific issues related to them, as well as issues raised in the material described in Section 1. The main points are summarized below.

2.1 Intra-regional model updates

As noted in Section 1, CS made separate pre-recorded presentations on the intra-regional models for the SCAG and MTC regions. During the meeting the Panel discussed the overall approach being used in the intra-regional models as well as specific issues in the material presented.

Some members of the Panel believe the ultimate goal should be to replace separate intra-regional models with a single model covering all long-distance trips (intra- and inter-regional). However, recognizing that this is not practical for the immediate needs of the next Business Plan, the Panel postponed further discussion of that to a later time when it can be considered as a potential part of Model 2.0. The reason for this concern is that developing the long distance models from the existing regional models, which have a more detailed structure, adds significant complexity to the model relative to its value and imposes a heavy cost in maintenance and computer run-time. This problem has been reduced to a limited extent by adopting a consistent structure for both of the intra-regional models, rather than separate versions for the SCAG and MTC regions.

The Panel advanced several suggestions for near-term improvements to the intra-regional models:

- It is imperative that the intra-regional mode choice models be properly calibrated. The Panel reiterated an earlier request for a memorandum describing the calibration approach proposed by CS. During our January 2013 meeting, the Panel requested that the CS team either use the approach recommended by FTA or clearly propose and communicate an alternate approach. CS did neither in the pre-recorded presentation. The approach presented to the Panel does not properly consider the implications of calibration for forecasting high-speed rail (HSR). The FTA approach recommends segmentation of the transit and walk-to-transit alternative-specific constants by socioeconomic category and the use of technology-specific constants across access and egress nests. The Panel provided a detailed explanation of this approach to CS, and will iterate quickly with CS as soon as it receives their memorandum.
- Mode choice models evaluate travel options created by path-finding algorithms. For example, a traveler may have two realistic choices to travel from home to work: driving or taking transit. A path-finding algorithm would find the best route through the highway network and then “skim” the attributes (such as travel time) of that route. Similarly, a transit path-finding algorithm must weigh trade-offs between faster, less frequent transit service and slower, more frequent service. These trade-offs are informed by path building parameters, which may, for example, specify that waiting for a transit vehicle is

approximately two to three times as onerous as riding in one. It is desirable for these path-building parameters to be consistent with the coefficients in the mode choice model that evaluate the disutility of the same travel time elements. In their initial specification and calibration of the SCAG intra-regional model, CS enforced this consistency by modifying the path building parameters to be equal to the mode choice coefficients from the so-called TransBay model. Because the mode choice coefficients differed by trip purpose, separate skims are required for each trip purpose. This is undesirable from a data management perspective and is also behaviorally curious: why would someone going shopping prefer a different transit path than someone going out to eat? The Panel recommended that CS consider another approach: modifying the mode choice coefficients such that a consistent set of mode choice coefficients and path parameters will be used across trip purposes. The Panel asked CS to consider their current approach as well as this one.

- The existing TransBay models use a log-transformed cost variable in the mode choice models for select trip purposes. The Panel recommended CS carefully consider the implications of using this functional form in the context of forecasting HSR travel. Because HSR will be a high cost, high-speed option for intra-regional travelers, the log transformation may not be desirable, as it may not adequately communicate the disutility of the high cost to travelers. The Panel asked CS to think through the impact of using this functional form in the context of HSR forecasting and proposed the alternative of cost divided by log of income.
- CS recommended calibrating the intra-regional models to simulated data from the travel models currently used by SCAG and MTC. This is an unusual and risky approach, relative to the far more common approach of calibrating the models to observed data. The Panel's concern is that the HSR models need to have a firm understanding of the way travelers in these regions use commuter rail service, as commuter rail is the existing service most similar to how future HSR service will operate within the region. Because existing commuter rail represents such a small portion of regional travel (e.g., in the Bay Area, commuter rail riders make about 40,000 out of more than 23,000,000 typical weekday trips, or less than 0.2 percent), it strikes the Panel as unwise to assume, a priori, that the existing travel models adequately represent the markets important for HSR forecasting. The Panel asked CS to carefully consider the risks associated with this approach relative to using observed data and report the results of their review.

2.2 Status of the new 2013 survey

Kimon Proussaloglou provided an overview of the progress on the 2013 revealed preference-stated preference (RP-SP) survey. The pre-testing of the survey is complete, and resulting final design changes in the questionnaire are underway. CS plans to start the survey in the next few weeks, assuming that final design decisions can be made within the next week. CS provided the Panel with proposed final survey instruments, along with a memorandum explaining their development, on March 21. Overall, the Panel is satisfied with the survey design, subject to a few final issues which were discussed during the meeting and/or provided to CS immediately after.

During the pre-test, some survey respondents (n out of N administered) discontinued the interview of the phone survey test, necessitating a design change to make the survey shorter. This was a possible outcome considered in the survey. CS has the option of using or deleting the

additional responses to the N - n surveys and adjusting the sample factors for the proportion of n/N . The Panel also discussed the rail survey test, which was administered to riders of the Capitol Corridor line. It was concluded that the instrument is likely robust in spite of finding a large number of non-traders; that is, respondents who make the same choice in every SP experiment. The Panel expressed their confidence in the ability of CS to address these issues by adjusting the attributes of latter questions in an attempt to increase the number of traders, and to move forward quickly with the execution of the survey.

It is apparent that the data collection required to meet the specifications for V1.5 is too far behind schedule for the model to be completed by mid-June as required by the current schedule for producing 2014 BP. Thus, CS should complete a detailed work plan that will best meet the near-term needs of the Authority. This work plan should include a two-stage plan responding to the current and potentially extended schedules.

The first stage will be designed to accomplish two goals:

1. Provide a model by June 1 that is useful for the 2014 BP based on its advantages over version 1.1 and
2. Identify valuable interim steps to enhance the Version 1.1 model to a 1.2 or 1.3 model.

The second stage should:

1. Define the tasks required for full implementation of Version 1.5 if the BP deadline is extended by 4.5 months. CS should confirm that it is feasible for these tasks to be completed by mid-November so that a Version 1.5 model would be available for use in the 2014 BP.
2. Define the main advantages of Version 1.5 over the first stage, including:
 - a. Incorporating new data that will give the model an updated base in its main data, enlarge the data set permitting greater precision in estimation, and taking advantage of some improvements in the survey design
 - b. Re-estimate Access/Egress mode choice jointly with main mode choice. This will improve the consistency between behavioral parameters estimated in these closely related model components, allow imposition of value constraints among various components of travel time and include two distinctly different economic periods.

2.3 Data development for model components for long distance trips

Except for long-distance intra-regional trips, which will be predicted by the models discussed in Section 2.2, the main set of models for long-distance trips within California is being developed along lines discussed extensively in earlier reports. These models include trip frequency, destination, main mode, and access mode. This section describes some preliminary data needed for estimation and application of these models, aside from the survey results. The next section describes the model estimation process, including specification of functional forms for utility expressions.

Considerable work has been carried out on the development of zone-to-zone travel time (skim) data. These data are required for the estimation and application of most model components,

making their robust derivation and checking an important antecedent to model estimation. Automobile skims from the California statewide model by period (peak versus non-peak) are averaged for use in the Version 1.5 model. Intercity transit skims are built from routes and fares explicitly coded in the model. The Panel suggested that a non-linear waiting time expression be considered either through the use of line segments, for example, separate coefficients for waiting time less than 15 minutes and greater than 15 minutes, or by adopting a non-linear transformations such as log of time.

The panel noted that the CS' selection of rail station or airport is based on characteristics of automobile access and egress, not transit access or egress. This simplification is probably sufficiently accurate for determining rail boardings by station, but is not adequate to support more detailed questions. For example, the model would not predict that improving local transit access to a particular rail station would attract more travelers to that station. Thus, the Panel considers this simplification to be adequate for the model's current use, but believes it should be replaced by the access mode logsum or other non-linear transformation as soon as possible.

The proposed initial waiting time for rail station assignment and station-to-station skims will be calculated as 20 percent of the rail main mode headway. Transfer waiting time will be defined as 50 percent of the headway. However, the basis for these times is not given. These assumptions will be revisited during the main mode choice model estimation work. Scheduled airport-to-airport travel times will be used for air modes.

2.4 Estimation of long distance choice model development

Initial estimation results from the re-formulated trip frequency model were reviewed. Data from the 2012 California Household Travel Survey (CHTS) was used to develop this model, which resulted in frequencies similar to those obtained by CS through their analysis of the Harris Interactive Poll results. The Panel felt that this presented convincing support of the CHTS long distance trip frequencies, making them suitable for use in the Version 1.5 model. It also increases the Panel's confidence in the results from the survey conducted using the Harris Interactive Poll.

CS recreated the 2005 RP dataset from the original survey data, enabling both RP and SP data information from the survey to be used in re-estimation of the long distance models. CS and the panel plan to add the 2013 RP-SP survey data as soon as available, to be used in combination with 2005 data. The Panel and CS reviewed at length preliminary model estimation results based on the 2005 data, especially for the main mode and access and egress modes.

The Panel believes the estimation results for choice of access and egress mode reveal logical structures, and are commendable in their parsimonious inclusion of explanatory variables. Most of the constants used in earlier versions of the models have been removed; resulting in more easily understood and interpreted formulations. The overall fit of the models is not as good as the Version 1.0 models, in which several parameters were asserted or were calibrated to match observed ridership by mode. For this reason, it was decided that alternative forms can still be investigated. There is no basis to expect that the addition of 2013 RP-SP survey data will improve the model fit since the data will cover two different economic periods. In the interim, the Panel recommended a four-step approach to isolating the differences between the existing models and those presented. These steps would begin from the original (Version 1.0) model:

1. Replace old with new network information, in order to compare results for same formulations with new data;
2. Re-estimate with revised specifications, using only the original SP data;
3. Add the 2005 RP data and re-estimate the models, so as to compare the results with SP data only and RP data only to those with combined SP and RP.
4. Compare the 2005 RP/SP and 2013 RP/SP estimation results and the joint 2005 and 2013 estimation results.
5. Report and interpret the changes between the estimation results in each step.

The results of the main mode choice model estimation were much better than those previously obtained, with most of the coefficients displaying significant t-statistics. Perhaps not unexpectedly, the coefficient values are often different from coefficients of comparable variables in the access and egress models. The latter will likely be constrained relative to those from the main mode choice model during the joint main, access and egress mode estimation. These discrepancies provide evidence that a joint estimation of access, egress, and main mode choice models will likely be the best way to obtain internally consistent parameter estimates. A final determination will await interpretation of the combined RP-SP survey data from 2005 and 2013.

3 CHSRA Coordination

Jeff Morales briefed the Panel by teleconference on issues faced by the Authority since the last meeting. The Authority is presently evaluating a revised initial operating segment that would operate between Merced and Palmdale. A large number of scenarios will be tested to identify the most efficient and cost-effective alternative. As part of this reorientation the Authority has requested a four-month extension to the deadline for submitting the 2014 Business Plan.

The Panel discussed the implications of the requested extension and what the absence of the 2013 RP-SP survey data means for completion of the Version 1.5 update. If the extension is approved, the Panel remains hopeful that CS can complete the Version 1.5 modeling system using the 2013 RP-SP data. V1.5 will produce forecasts based on more recent data and will effectively average results for two distinct time periods; 2005 which gives a somewhat pessimistic estimate and 2013 which gives a somewhat more optimistic estimate based on a partial recovery. This combined data set will increase the confidence in the forecast results. Two recommended approaches, depending on which deadline applies, were presented to the CS team by HSRA. They are presented in Table 1. While acknowledging that the 2013 RP-SP survey is only one of many new data sources proposed to be included in the Version 1.5 model development, the Panel believes that it is the most important new data source for estimating the models and its absence would require labeling the resulting version something below 1.5, perhaps 1.3. If the current deadline holds, the team should implement V1.3 model. If the deadline is extended, every effort should be made to complete a more advanced model.

CS agreed to forward their proposed interim model structure and timeline to the Panel as soon as possible following the meeting. This material is long overdue. Further, the PRP requested but has not yet received guidance as to what demand analysis studies HSRA needs to complete for the 2014 BP. The Panel hereby requests such specification from HSRA management or its designee.

Table 1: Modeling strategies for the 2013 Business Plan

Component	Version 1.3 (operational by June 1, 2013)	Version 1.5 (operational by October 1, 2013)
Trip frequency model	Re-estimate the model using the CHTS and updated skim matrices	Same
Destination choice model	Re-calibrate existing model to CHTS trip frequency distributions using updated skim matrices	Re-estimate and re-calibrate the model using CHTS data and updated skim matrices
Access, egress, and main mode choice models	Finish separate re-estimation of models using 2005 RP-SP survey data	Jointly estimate access, egress, and main mode choice using the 2005 and 2013 RP-SP survey data
Modeling system	Re-calibrate and re-validate the model to 2010 conditions; validate by backcasting to 2000 and by analyzing a “NEC-like” scenario, as was done with the Version 1.1 model	Same

4 Principal findings and conclusion

The admittedly ambitious schedule put forward by the Panel, and agreed to by CS, of delivering a Version 1.5 modeling system by July 1 in order to be used for forecasting in support of the 2014 Business Plan will not be met. This is primarily due to delays in making funding available for both the 2013 survey and other work undertaken by CS. The PRP initiated discussions with CS regarding a contingency plan that strives to achieve the best possible model to use for the 2014 Business Plan, given the current state of the modeling system and the delay in the award of committed funds. The Authority is seeking an extension of the statutorily required deadline for the 2014 Business Plan. If this extension is granted, the likelihood of the Version 1.5 model being ready in time for the 2014 Business Plan increases but it is still doubtful that a fully operational V1.5 will be available to meet the extended schedule. Without the extension, there is no possibility to have an operational V1.5. It is for this reason that the V1.3 option has been proposed. While this version has deficiencies it is superior to the previously used V1.0 or V1.1 model systems.